



NOTES

PICORNAVIRUSES

MICROBE OVERVIEW

- Have small, cytoplasmic, single-stranded, linear, positive-polarity RNA

Taxonomy

- Family *Picornaviridae*; 35 genera (e.g. *Enterovirus*, *Aphovirus*, *Cardiovirus*, *Rhinovirus*, *Hepatovirus*)

Morphology

- Non-enveloped
- Icosahedral capsid
- Diameter
 - 27–30nm (smallest of RNA viruses)
- Genome length
 - About 2500nm

Transmission

- Hosts: humans, birds, vertebrates

PATHOGENIC PICORNAVIRUSES

GENUS	SPECIES	DISEASE
ENTEROVIRUS	<i>Enterovirus A</i> ; coxsackievirus A	- Infects skin, mucous membranes - Causes herpangina; acute hemorrhagic conjunctivitis; hand, foot, and mouth (HFMD) disease
	<i>Enterovirus B</i> ; coxsackievirus B	- Infects heart, pleura, pancreas, liver - Causes pleurodynia, myocarditis, pericarditis, hepatitis - May lead to pericardial effusion
	<i>Enterovirus C</i> ; poliovirus	- Causes poliomyelitis ("polio")
	<i>Rhinovirus A</i>	- Causes the "common cold"
HEPATO VIRUS	Hepatitis A	- Humans: only reservoir - Infects hepatocytes - Causes acute hepatitis

VISIT...

LANZAROTE
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COXSACKIE VIRUS

osms.it/coxsackievirus

PATHOLOGY & CAUSES

HFMD (hand, foot and mouth disease)

- Clinical syndrome characterized by oral enanthem; maculopapular/vesicular rash of hands, feet
 - Common exanthem in children and adults
 - Most commonly caused by coxsackie A virus

Herpangina

- Benign clinical syndrome characterized by fever, papulo-vesiculo-ulcerative oral enanthem
 - Most commonly caused by coxsackie A virus
- Transmission person to person via oral-fecal route or respiratory aerosols → incubation for 3–5 days → virus replicates in the submucosal lymphoid tissue of pharynx or lower intestine → spread to regional lymph nodes (minor viremia) → dissemination throughout the body → major viremia

RISK FACTORS

- Age
 - Most common in children <10 years
- Season
 - Spring, summer, autumn
- Poor hygiene

COMPLICATIONS

- Reduced oral intake → dehydration
- Rhombencephalitis
- Acute flaccid paralysis
- Aseptic meningitis
- Myocarditis
- Pancreatitis

SIGNS & SYMPTOMS

HFMD

- Mouth, throat pain
 - Young children may refuse to eat
- Mild fever
- Lethargy
- Oral enanthem: on tongue, buccal mucosa
 - Erythematous macules → vesicles with halo of erythema
- Exanthem: macular, maculopapular, vesicular; nonpruritic, usually not painful
 - Involves hands (including palms), feet (including soles), buttocks, legs, arms
 - Palmer and plantar desquamation 1–3 weeks after presentation

Herpangina

- Acute onset with high fever; may present with febrile seizure
- Anorexia, emesis, irritability common in young children
- Malaise, headache, sore throat, dysphagia, abdominal pain
- Papulovesicular lesions in throat
- Additional findings
 - Neck stiffness, positive Kernig sign, cervical adenitis



Figure 89.1 Characteristic mouth lesions of hand, foot and mouth disease.

DIAGNOSIS

LAB RESULTS

- Throat, stool, vesicular fluid samples for cell culture/polymerase chain reaction (PCR)



Figure 89.2 Characteristic mouth lesions of hand, foot and mouth disease.

TREATMENT

MEDICATIONS

- Analgesia, fluids
- No specific antiviral therapy

OTHER INTERVENTIONS

- Treat complications (e.g. neurological, cardiovascular)

Prevention

- Infection control practices
 - Hand hygiene; isolate hospitalized individuals; contact precautions

HEPATITIS A VIRUS

osms.it/hepatitis-a-virus

PATHOLOGY & CAUSES

- Hepatitis A virus (HAV) → hepatitis A infection
- Reservoir
 - Humans
- Transmission
 - Oral-fecal route
- Infection of hepatocyte by HAV → replication hepatocyte cytoplasm → hepatocellular damage → HAV-specific CD8+ T lymphocytes, natural killer cells destroy infected hepatocytes → host's immune response to HAV → hepatic injury
- Infection usually self-limiting (does not become chronic); results in life-long immunity (IgG antibodies)

RISK FACTORS

- Poor sanitation
- Limited access to clean water

- Travel to low resource countries

COMPLICATIONS

- **Cholestatic hepatitis:** characterized by prolonged jaundice
- **Relapsing hepatitis:** symptoms relapse after acute illness
- **Autoimmune hepatitis:** chronic hepatitis, characterized by hyperglobulinemia

SIGNS & SYMPTOMS

- Usually self-limiting; fulminant hepatic failure rare
- Incubation period
 - 28 days (average)
- Symptoms
 - Nausea, vomiting, anorexia, fever, malaise, abdominal pain

- Signs
 - Dark urine, pale stools, **jaundice** (peaks within two weeks of infection), pruritus, scleral icterus, hepatosplenomegaly

DIAGNOSIS

LAB RESULTS

- Elevated serum aminotransferase levels may indicate diagnosis
- Established diagnosis by detection of serum **IgM anti-HAV antibodies**
 - Serum IgG antibodies in absence of anti-HAV IgM indicates previous infection/vaccination

TREATMENT

MEDICATIONS

- Medications known to cause liver damage should be avoided/used with caution

Prevention

- Hepatitis A vaccination
- Immune globulin; passive immunization indicated for
 - Immunocompromised individuals (unable to mount immune response to HAV vaccine)
 - < 12 months, > 40 years
 - Individuals with chronic liver disease
 - Allergy to hepatitis A vaccine

OTHER INTERVENTIONS

Prevention

- Infection control practices
 - Handwashing; avoid tap water, raw foods in poorly-sanitized areas

POLIOMYELITIS (POLIO)

osms.it/poliomyelitis

PATHOLOGY & CAUSES

- Infectious disease caused by poliovirus
- Characterized by (rare but devastating) cases of muscle weakness, permanent paralysis
 - Most infections remain asymptomatic
 - Some experience minor symptoms (e.g. fever, sore throat, headache)
 - Some may recover from muscle paralysis
- Natural host
 - Humans
- Transmitted by **fecal-oral route**; less commonly via respiratory droplets
 - Asymptomatic, infected persons may shed virus
- Pathogenesis
 - Oral entry → poliovirus infects cells

of mouth, nose, throat → spread to lymphatics → primary replication in tissue of **gastrointestinal tract and oropharynx** → primary (minor) viremia → invasion of the **central nervous system** → replication in motor neurons of spinal cord, brain stem, or motor cortex → **destruction of motor neurons** → secondary (major) viremia and **paralysis**

RISK FACTORS

- Unvaccinated status
- Travel to countries endemic for poliovirus

COMPLICATIONS

- Post-polio syndrome
 - Slowly developing muscle weakness similar to initial infection
- Bulbar poliomyelitis

- Infection of brain stem; may lead to drooling, aspiration pneumonia, respiratory muscle paralysis
- Skeletal malformations due to muscle paresis, **paralysis**
- Equinus foot (club foot)
- Stunted growth
- Osteoporosis, bone fractures
- Urinary tract infections, kidney stones
- Paralytic ileus
- Myocarditis, cor pulmonale

SIGNS & SYMPTOMS

Minor illness/minor viremia

- Abortive poliomyelitis
 - Nausea
 - Vomiting
 - Abdominal pain
 - Constipation
 - Diarrhea
 - Sore throat
 - Mild **fever**
 - Coryza

Major illness/major viremia

- Involvement of central nervous system (CNS)
- Nonparalytic aseptic meningitis
- **Headache**
- Neck, back, abdominal, extremity pain
- **Fever**
- Vomiting
- Lethargy
- Irritability

Paralytic disease

- Varies from one muscle to muscle group
- Reduced tone; often asymmetric
- Affects proximal muscles > distal muscles
- Affects legs > arms
- Worsens over 2–3 days

Acute flaccid paralysis

- Complete paralysis; spinal, bulbar, bulbospinal
- Quadriplegia/respiratory failure
- Reflexes absent
- Sensation intact



Figure 89.3 An individual with atrophy of the muscles of the right leg caused by polio.

DIAGNOSIS

- Acute-onset **flaccid paralysis**

LAB RESULTS

- PCR detection of poliovirus RNA from cerebrospinal fluid; cerebrospinal fluid (CSF) may also show ↑ **leukocytes**, ↑ **protein**
- Alternative
 - Detection by poliovirus isolation, culture (from throat secretions); comparison of viral titers in acute, convalescent sera

TREATMENT

MEDICATIONS

Antiviral therapy

- Role remains uncertain

Prevention

- **Passive immunization:** gamma globulin; reduces infected individuals' disease severity
- Inactivated poliovirus vaccine
 - Given in high-income countries
 - Cannot revert to paralytic form
- Live attenuated oral poliovirus vaccine
 - Inexpensive, easy to administer; given in countries where virus endemic
 - **Risk:** attenuated virus reverting to paralysis-causing form

OTHER INTERVENTIONS

- Physical therapy; respiratory failure → mechanical ventilation
- No effective treatment for restoring motor neuron function



Figure 89.4 An individual with polio inside an iron lung, which provided mechanical ventilation by creating negative pressure.

RHINOVIRUS

osms.it/rhinovirus

PATHOLOGY & CAUSES

- The causative agent of **most common colds**
- **> 100 serotypes**
- Most frequent human infectious disease, preferentially infecting the upper respiratory tract
- Usually causes mild, self-limiting disease, with increased incidence in early autumn (September–November) and in Spring (March–May)
- Predisposes to other infections
 - Otitis media in children, community acquired pneumonia
- Potential to infect the lower respiratory tract → exacerbation of asthma, chronic bronchitis
- Inoculation of the nose or conjunctiva → intracellular adhesion molecule-1 (ICAM-1) attachment → incubation (2–4 days)

→ host inflammatory response to virus
→ elaboration of inflammatory mediators, recruitment of polymorphonuclear leukocytes → symptoms → illness lasts about 1–2 weeks

Transmission

- Airborne droplet nuclei/aerosols (from sneezing, coughing)
- Droplet transmission
- Direct contact (e.g. hand contact → rubbing eyes, nasal mucosa)
- Fomites

RISK FACTORS

- Fatigue (insufficient sleep)
- Psychological stress
- Work in daycare/schools
- Smoking
- Underlying chronic disease

COMPLICATIONS

- Sinusitis
- Lower respiratory tract disease
- Asthma exacerbations
- Acute otitis media

SIGNS & SYMPTOMS

- Cough
- Coryza
- Rhinorrhea (clear/purulent)
- Sore throat
- Myalgia
- Fatigue, malaise
- Headache
- Anorexia
- Fever

DIAGNOSIS

DIAGNOSTIC IMAGING

- Lower respiratory tract infection → chest radiograph

OTHER DIAGNOSTICS

- Nasal cavity examination: swollen, erythematous nasal turbinates

TREATMENT

MEDICATIONS

- Analgesics
 - Relieve headache, ear pain, myalgia
 - E.g. acetaminophen, nonsteroidal anti-inflammatory drugs
- Antihistamine/decongestant combinations
- Cough suppressants

OTHER INTERVENTIONS

- Zinc supplements at initial infection may reduce duration